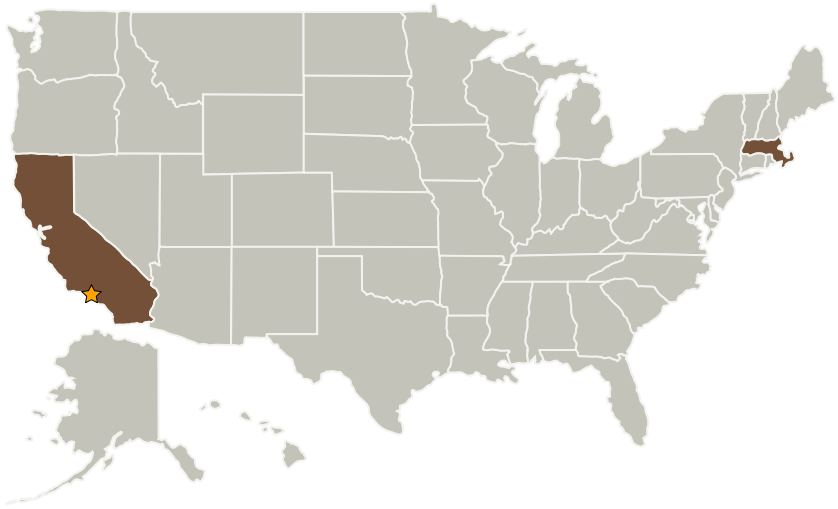
Distributed Formation State Estimation Algorithms Under Resource and Multi-Tasking Constraints, Phase II

Completed Technology Project (2007 - 2009)

Project Introduction

Recent work on distributed multi-spacecraft systems has resulted in a number of architectures and algorithms for accurate estimation of spacecraft and formation states. The estimation accuracy achievable during spacecraft formation operation depends not only on the algorithms, but also on their actual implementation and communication related delays. Typically, the algorithms are implemented on a real-time multi-tasking processor that allocates on-board computational resources to multiple tasks according to some scheduling policy. The processor's task scheduler may induce delays and preempt measurement processing and estimation tasks in favor of other tasks. Hence, estimation accuracy and in general the performance of any embedded algorithm can be significantly lower than expected during execution. The goal of this project is to develop distributed spacecraft state estimation algorithms that account for real-time multi-tasking processor constraints and delays in the availability of measurements and make the best use of limited onboard computing resources. We bring together new advances in advanced Kalman filtering techniques to develop an innovative framework for the design of embedded distributed state estimation algorithms and software. We will deliver to NASA JPL a novel ``any time'' Kalman Filter (AKF) architecture and software for distributed state estimation that, i) selects and uses the best measurements under given CPU constraints, and ii) continues to improve the accuracy of estimates by opportunistically using any additional CPU resources that become available.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Scientific Systems Company, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Woburn, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.1 Situational and Self Awareness
    - TX10.1.2 State Estimation and Monitoring